Monitoring Changes in Luminescence of 4-Methyl Umbelliferone in Presence of Colloidal Silver Nanoparticles

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Coumarines are compounds originating from the nature that can be used in industry; they are broadly used in cosmetics, in food and drinks as a flavoring. Coumarin derivatives are heterocyclic compounds containing oxygen atom and carbonyl group. Most of them have a very efficient fluorescing ability. Umbelliferone and its methyl derivatives can be found in some of the Umbellifera plant family but the main source of these compounds is a plant named Ferula galbaloferra and is found in a vast area in Damavand and Alborz in Iran.

Fluorescence quenching is a technique to understand the interaction within the medium in view of the special role of surfaces of the nanoclusters in guiding and modifying physicochemical processes. Interaction of a dye with the medium at the molecular level is reflected in its visible and fluorescence spectra. The typical fluorescence spectrum of 4-MU containing variable amounts of silver nanoparticles, is shown in as follows:

The following equation was obtained by fitting the experimental data on Stern-Volmer equation [2]:

\[
\frac{I_0}{I} = 933.59[Ag] - 3.0201 \quad R = 0.99
\]

Silver nanoparticles were prepared according the literature [3] with some modifications. Fluorescence studies demonstrated that the fluorescence intensity of 4-MU was decreased with increasing the amount of silver nanoparticles in aqueous solution. Fluorescence intensity decrease of 4-MU is explained by electron transfer process and the formation of a nonfluorescent ground state complex [4].

In conclusion, the probe molecules (4-MU) are adsorbed on the surface of the nanoparticles and the formation of a nonfluorescent ground state complex causes to decrease fluorescence intensity of 4-MU, so the fluorescence is quenched.

REFERENCES